NASA/SP—2000-7039/SUPPL56
January 2000

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Introduction

Several thousand inventions result each year from the aeronautical and space research supported by the National Aeronautics and Space Administration. The inventions having important use in government programs or significant commercial potential are usually patented by NASA. These inventions cover practically all fields of technology and include many that have useful and valuable commercial application.

NASA inventions best serve the interests of the United States when their benefits are available to the public. In many instances, the granting of nonexclusive or exclusive licenses for the practice of these inventions may assist in the accomplishment of this objective. This bibliography is published as a service to companies, firms, and individuals seeking new, licensable products for the commercial market.

The *NASA Patent Abstracts Bibliography* is a semiannual NASA publication containing comprehensive abstracts of NASA owned inventions covered by U.S. patents and applications for patent. The citations included in the bibliography arrangement of citations were originally published in NASA's *Scientific and Technical Aerospace Reports (STAR)* and cover *STAR* announcements made since May 1969.

The citations published in this issue cover the period January 1999 through June 1999. This issue includes 10 major subject divisions separated into 76 specific categories and one general category/division. (See Table of Contents for the scope note of each category, under which are grouped appropriate NASA inventions.) This scheme was devised in 1975 and revised in 1987 in lieu of the 34 category divisions which were utilized in supplements (01) through (06) covering *STAR* abstracts from May 1969 through January 1974. Each entry consists of a *STAR* citation accompanied by an abstract and, when appropriate, a key illustration taken from the patent or application for patent. Entries are arranged by subject category in ascending order.

A typical citation and abstract presents the various data elements included in most records cited. This appears after the table of contents.

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Table of Contents

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

12 Astronautics (General) N.A.

For extraterrestrial exploration, see *91 Lunar and Planetary Exploration.*

13 Astrodynamics N.A.

Includes powered and free-flight trajectories; and orbital and launching dynamics.

14 Ground Support Systems and Facilities (Space) N.A.

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators. *For related information, see also 09 Research and Support Facilities (Air).*

15 Launch Vehicles and Space Vehicles N.A.

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles. For related information, see also *20 Spacecraft Propulsion and Power.*

16 Space Transportation N.A.

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information, see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits, see *54 Man/System Technology and Life Support.*

17 Space Communications, Spacecraft Communications, Command and Tracking N.A.

Includes telemetry; space communication networks; astronavigation and guidance; and radio blackout. For related information, see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

18 Spacecraft Design, Testing and Performance 3

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls. For life support systems, see *54 Man/System Technology and Life Support.* For related information, see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics, and 16 Space Transportation.*

19 Spacecraft Instrumentation N.A.

For related information, see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

20 Spacecraft Propulsion and Power N.A.

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information, see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

Indexes

Two indexes are available. You may use the **Find** command under the **Tools** menu while viewing the PDF file for direct match searching on any text string. You may also view the indexes provided, for searching on *NASA Thesaurus* subject terms and author names.

Selecting an index above will link you to that comprehensive listing.

Typical Report Citation and Abstract

❶ 19970011223 NASA Langley Research Center, Hampton, VA USA

❷ Serrated-Planform Lifting-Surfaces

❸ McGrath, Brian E., Inventor, NASA Langley Research Center, USA; Wood, Richard M., Inventor, NASA Langley Research

❹ Center, USA; Oct. 22, 1996; 38p; In English

❺ Patent Info.: Filed 22 Oct. 1996; NASA-Case-LAR-15295-1; US-Patent-Appl-SN-734820

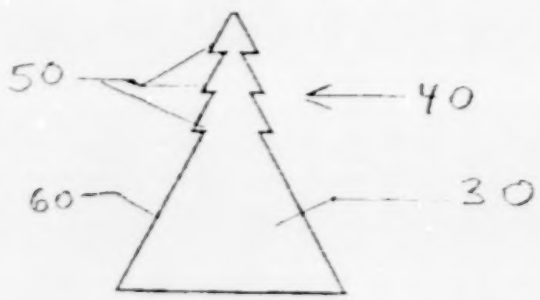
❻ Report No.(s): NAS 1.71:LAR-15295-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

❼ A set of serrated-planform lifting surfaces is provided which produces unexpectedly high lift coefficients at moderate to high angles-of-attack. Each serration, or tooth, is designed to shed a vortex. The interaction of the vortices greatly enhances the lifting capability over an extremely large operating range. Variations of the invention use serrated-planform lifting surfaces in planes different than that of a primary lifting surface. In an alternate embodiment, the individual teeth are controllably retractable and deployable to provide for active control of the vortex system and hence lift coefficient. Differential lift on multiple serrated-planform lifting surfaces provides an means for vehicle control. The important aerodynamic advantages of the serrated-planform lifting surfaces are not limited to aircraft applications but can be used to establish desirable performance characteristics for missiles, land vehicles, and/or watercraft.

❽ NASA

❾ *Angle of Attack; Lift; Vortex Shedding; Active Control; Lifting Bodies*

❿



Key

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A Continuing Bibliography (Suppl. 56)

JANUARY 2000

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 17 Space Communications, Spacecraft Communications, Command and Tracking and 32 Communications and Radar.

19990111573 NASA Pasadena Office, CA USA

Methods and Apparatus for Reducing Multipath Signal Error Using Deconvolution

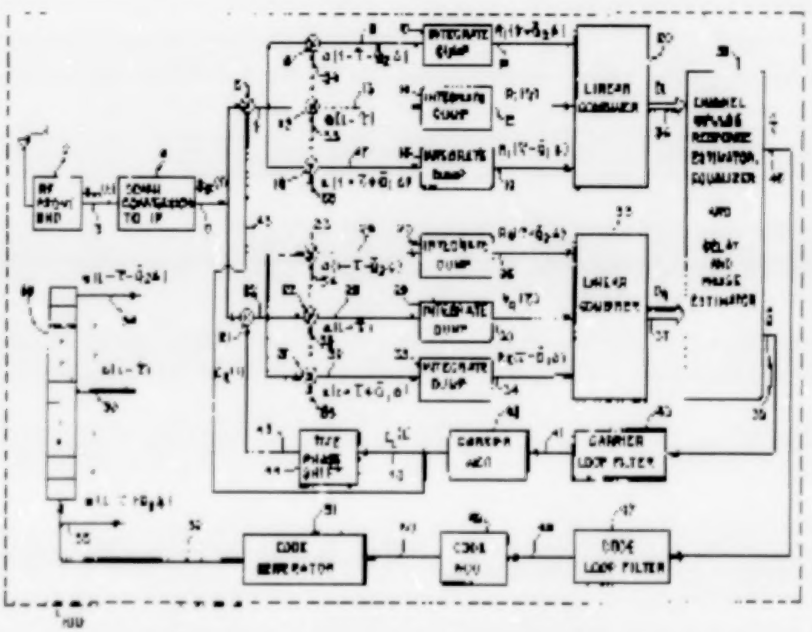
Kumar, Rajendra, Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Lau, Kenneth H., Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Jun. 29, 1999; In English

Patent Info.: Filed 16 Jan. 1997; NASA-Case-NPO-19602-1-CU; US-Patent-5,918,161; US-Patent-Appl-SN-786356; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A deconvolution approach to adaptive signal processing has been applied to the elimination of signal multipath errors as embodied in one preferred embodiment in a global positioning system receiver. The method and receiver of the present invention estimates then compensates for multipath effects in a comprehensive manner. Application of deconvolution, along with other adaptive identification and estimation techniques, results in completely novel GPS (Global Positioning System) receiver architecture.

Author

Signal Processing; Errors; Multipath Transmission



07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.

19990104277 NASA Langley Research Center, Hampton, VA USA

Jet Nozzle Having Centerbody for Enhanced Exit Area Mixing

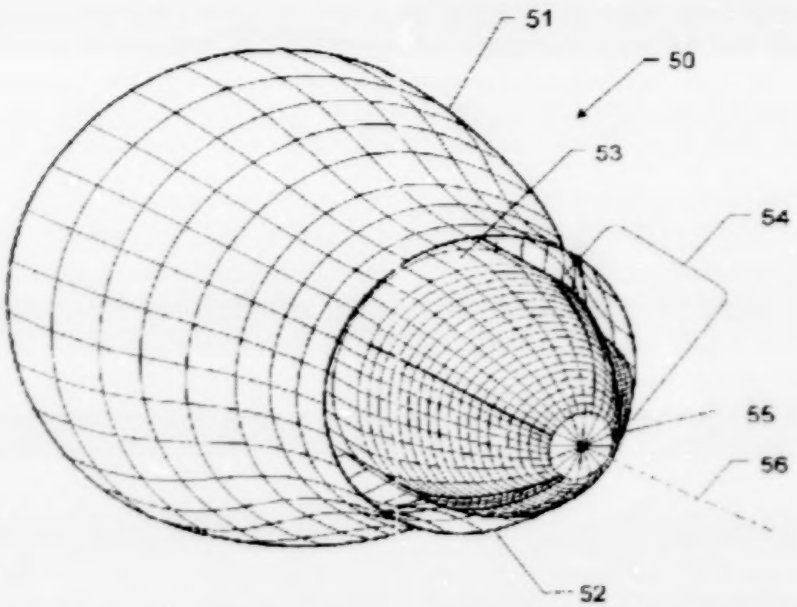
Seiner, John M., Inventor, NASA Langley Research Center, USA; Gilinsky, Mikhail M., Inventor, NASA Langley Research Center, USA; Jul. 20, 1999; In English; Provisional US-Patent-Appl-SN-016741, filed 2 May 1996

Patent Info.: Filed 2 May 1997; NASA-Case-LAR-15518-1; US-Patent-5,924,632; US-Patent-Appl-SN-850572; US-Patent-Appl-SN-016741; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A nozzle arrangement includes a nozzle and a centerbody. The longitudinal axis of the centerbody is coaxially aligned with the nozzle. The centerbody has a free end portion shaped to create vortices in exhaust exiting the exit area. The vortices enhance mixing action in the exhaust and reduce exhaust noise while augmenting thrust.

Author

Exhaust Nozzles; Nozzle Design; Coaxial Nozzles; Noise Reduction



20
SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also 07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion, and 15 Launch Vehicles and Space Vehicles.

19990104275 NASA Lewis Research Center, Cleveland, OH USA

Method and Apparatus for Pressure Pulse Arcjet Starting

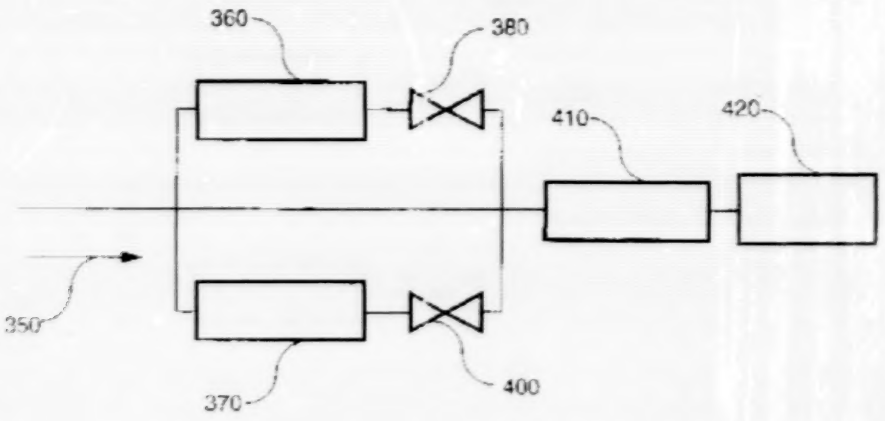
Sankovic, John M., Inventor, NASA Lewis Research Center, USA; Curran, Francis M., Inventor, NASA Lewis Research Center, USA; Aug. 10, 1999; In English; Division of US-Patent-Appl-SN-626742, filed 26 Mar. 1996, which is division of US-Patent-Appl-SN-236855, filed 2 May 1994

Patent Info.: Filed 5 Aug. 1997; NASA-Case-LEW-15665-3; US-Patent-5,934,068; US-Patent-Appl-SN-906550; US-Patent-Appl-SN-626742; US-Patent-Appl-SN-236855; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

The invention disclosed is directed to a method and apparatus for an arcjet starter. The invention discloses a method of moving an arc from the subsonic region of the thruster to the supersonic region by introducing a pressurized propellant into the cavity of the anode.

Author

Pressure Pulses; Jet Propulsion; Arc Jet Engines; Ion Engines; Electric Propulsion



24
COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials. For ceramic materials see 27 Nonmetallic Materials.

19990108574 NASA Lewis Research Center, Cleveland, OH USA

Method for Forming Fiber Reinforced Composite Bodies with Graded Composition and Stress Zones

Singh, Mrityunjay, Inventor, NASA Lewis Research Center, USA; Levine, Stanley R., Inventor, NASA Lewis Research Center, USA; Smialek, James A., Inventor, NASA Lewis Research Center, USA; Aug. 31, 1999; In English

Patent Info.: Filed 30 Dec. 1997; NASA-Case-LEW-16221-1; US-Patent-5,945,166; US-Patent-Appl-SN-001584; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A near-net, complex shaped ceramic fiber reinforced silicon carbide based composite bodies with graded compositions and stress zones is disclosed. To provide the composite a fiber preform is first fabricated and an interphase is applied by chemical vapor infiltration, sol-gel or polymer processes. This first body is further infiltrated with a polymer mixture containing carbon, and/or silicon carbide, and additional oxide, carbide, or nitride phases forming a second body. One side of the second body is spray coated or infiltrated with slurries containing high thermal expansion and oxidation resistant, crack sealant phases and the other side of this second body is coated with low expansion phase materials to form a third body. This third body consisting of porous carbonaceous matrix surrounding the previously applied interphase materials, is then infiltrated with molten silicon or molten silicon-refractory metal alloys to form a fourth body. The resulting fourth body comprises dense composites consisting of fibers with the desired interphase which are surrounded by silicon carbide and other second phases materials at the outer and inner surfaces comprising material of silicon, germanium, refractory metal suicides, borides, carbides, oxides, and combinations thereof The resulting composite fourth body has different compositional patterns from one side to the other.

Author

Fiber Composites; Composite Structures; Reinforcing Materials; Metal Working; Forming Techniques; Reinforcing Fibers

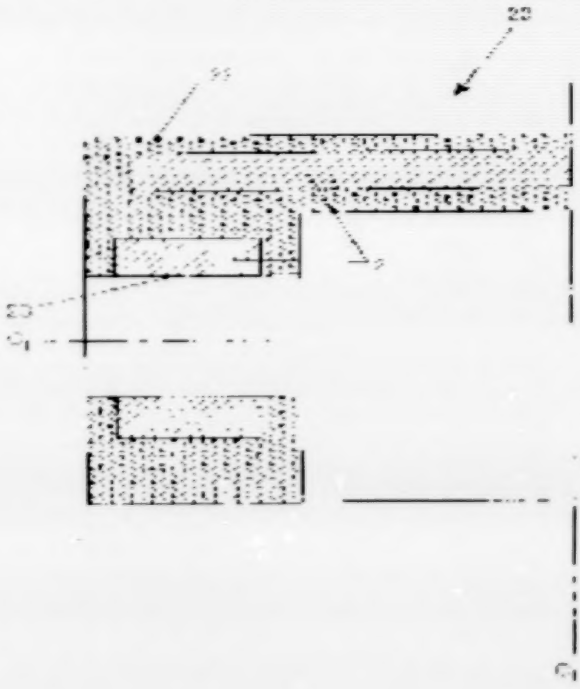
19990111588 NASA Langley Research Center, Hampton, VA USA

Method of Fabricating Chopped-Fiber Composite Piston

Rivers, H. Kevin, Inventor, NASA Langley Research Center, USA; Ransone, Philip O., Inventor, NASA Langley Research Center, USA; Northam, G. Burton, Inventor, NASA Langley Research Center, USA; Sep. 07, 1999; In English; Provisional US-Patent-Appl-SN-012930, filed 6 Mar. 1996

Patent Info.: Filed 5 Mar. 1997; NASA-Case-LAR-15643-1; US-Patent-5,948,330; US-Patent-Appl-SN-816403; US-Patent-Appl-SN-012930; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A three-dimensional piston molding is fabricated from a mixture of chopped, carbon tow filaments of variable length, which are prepregged with carbonaceous organic resins and/or pitches and molded by conventional molding processes into a near net shape, to form a carbon-fiber reinforced organic-matrix composite part. Continuous reinforcement in the form of carbon-carbon composite tapes or pieces of fabric can be also laid in the mold before or during the charging of the mold with the chopped-fiber mixture, to enhance the strength in the crown and wrist-pin areas. The molded chopped-fiber reinforced organic-matrix composite parts are then pyrolized in an inert atmosphere, to convert the organic matrix materials to carbon. These pyrolized parts are then densified by reimpregnation with resins or pitches, which are subsequently carbonized. Densification is also accomplished by direct infiltration with carbon by vapor deposition processes. Once the desired density has been achieved, the piston molds are machined to final piston dimensions, and piston ring grooves are added. to prevent oxidation and/or to seal the piston surface or near surface, the chopped-fiber piston is coated with ceramic and/or metallic sealants: and/or coated with a catalyst.
Author
Fabrication; Fiber Composites; Pistons; Molds



27
NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see 24 Composite Materials.

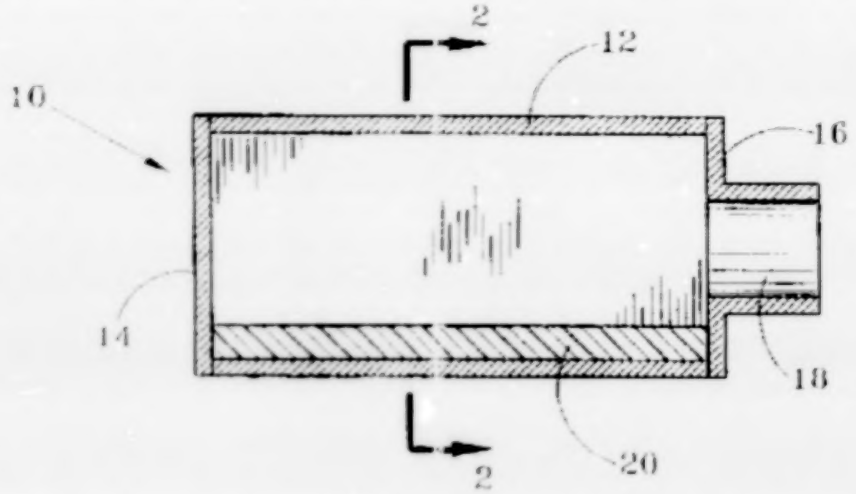
19990104281 NASA Lewis Research Center, Cleveland, OH USA
Polyimides Based on 4,4'-BIS(4-Aminophenoxy)-2,2' or 2,2', 6,6'-Substituted Biphenyl
Chuang, Chun-Hua K., Inventor, NASA Lewis Research Center, USA; Aug. 17, 1999; In English; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

This invention relates the novel diamines, the polyimide oligomers and the polyimides derived therefrom and to the method of preparing the diamines, oligomers and the poly- imides. The thermoplastic polyimides derived from the aromatic diamines of this invention are characterized as having a high glass transition temperature, good mechanical properties and improved process-ability in the manufacture of adhesives, electronic and composite materials for use in the automotive and aerospace industry.Me distinction of the novel aromatic diamines of this invention is the 2,2',6,6- substituted biphenyl radicals which exhibit noncoplanar

conformation that enhances the solubility of the diamine as well as the processability of the polyimides, while retaining a realatively high glass transition temperature and improved mechanical properties at useful temperature ranges.
Official Gazette of the U.S. Patent and Trademark Office
Procedures; Adhesives; Diamines; Polyimides; Polyphenyls; Oligomers; Mechanical Properties

19990104282 NASA Johnson Space Center, Houston, TX USA
Distributed Pore Chemistry in Porous Organic Polymers in Tissue Culture Flasks
Koontz, Steven L., Inventor, NASA Johnson Space Center, USA; Aug. 17, 1999; In English; Div. of US-Patent-Appl-SN-254361, filed 3 Jun. 1994, continuation-in-part of US-Patent-Appl-SN-857901, filed 26 Mar. 1992 and US-Patent-Appl-SN-997265, filed 23 Feb. 1993, div. of US-Patent-Appl-SN-894505 and US-Patent-Appl-SN-429739
Patent Info.: Filed 9 Jul. 1997; NASA-Case-MSC-22419-5; US-Patent-5,939,314; US-Patent-Appl-SN-903280; US-Patent-Appl-SN-254361; US-Patent-Appl-SN-857901; US-Patent-Appl-SN-997265; US-Patent-Appl-SN-894505; US-Patent-Appl-SN-429739; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A method for making a biocompatible polymer article using a uniform atomic oxygen treatment is disclose. The substrate may be subsequently optionally grated with a compatibilizing compound. Compatibilizing compounds may include proteins, phosphorylcholine groups, platelet adhesion preventing polymers, albumin adhesion promoters, and the like. The compatibilized substrate may also have a living cell layer adhered thereto. The atomic oxygen is preferably produced by a flowing afterglow microwave discharge, wherein the substrate resides in a sidearm out of the plasma. Also, methods for culturing cells for various purposes using the various membranes are disclosed as well. Also disclosed are porous organic polymers having a distributed pore chemistry (DPC) comprising hydrophilic and hydrophobic regions, and a method for making the DPC by exposing the polymer to atomic oxygen wherein the rate of hydrophilization is greater than the rate of mass loss.
Author
Culture Techniques; Tissues (Biology); Cells (Biology); Porosity; Porous Materials



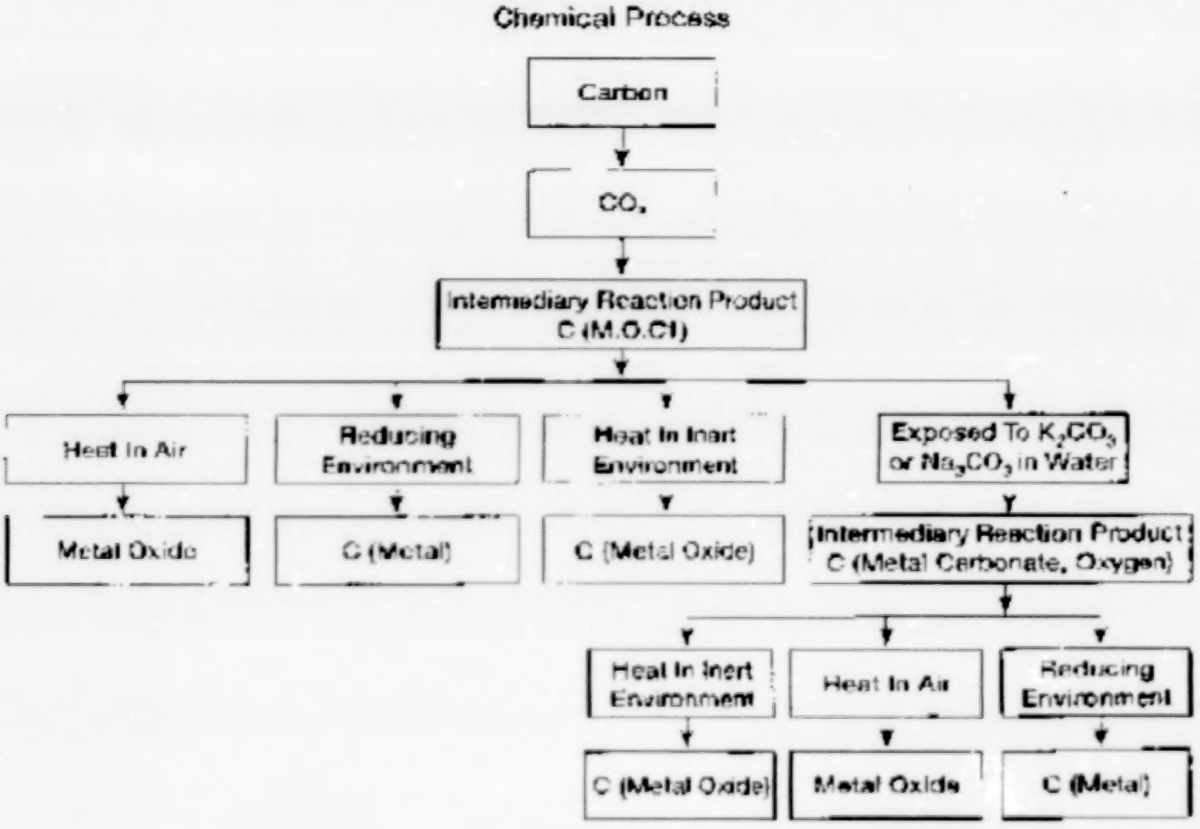
19990104283 NASA Ames Research Center, Moffett Field, CA USA
Waterproof Silicone Coatings of Thermal Insulation and Vaporization Method
Cagliostro, Domenick E., Inventor, NASA Ames Research Center, USA; Aug. 17, 1999; In English
Patent Info.: Filed 11 Aug. 1997; NASA-Case-ARC-14120-1-GE; US-Patent-5,939,141; US-Patent-Appl-SN-909711; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

Thermal insulation composed of porous ceramic material can be waterproofed by producing a thin silicone film on the surface of the insulation by exposing it to volatile silicone precursors at ambient conditions. When the silicone precursor reactants are multi-functional siloxanes or silanes containing alkenes or alkynes carbon groups higher molecular weight films can be produced. Catalyst are usually required for the silicone precursors to react at room temperature to form the films. The catalyst are particularly useful in the single component system e.g. dimethylethoxysilane (DNMS) to accelerate the reaction and decrease the time to

waterproof and protect the insulation. In comparison to other methods, the chemical vapor technique assures better control over the quantity and location of the film being deposited on the ceramic insulation to improve the waterproof coating.
Official Gazette of the U.S. Patent and Trademark Office
Thermal Insulation; Waterproofing; Silicones; Vaporizing; Porous Materials

19990108573 NASA Lewis Research Center, Cleveland, OH USA
Elemental Metals or Oxides Distributed on a Carbon Substrate or Self-Supported and the Manufacturing Process Using Graphite Oxide as Template
Hung, Ching-Chen, Inventor, NASA Lewis Research Center, USA; Sep. 07, 1999; In English; Division of US-Patent-Appl-SN-833107, filed 4 Apr. 1997
Patent Info.: Filed 5 Nov. 1998; NASA-Case-LEW-16221-1; US-Patent-5,948,475; US-Patent-Appl-SN-186831; US-Patent-Appl-SN-833107; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A process for providing elemental metals or metal oxides distributed on a carbon substrate or self-supported utilizing graphite oxide as a percursor. The graphite oxide is exposed to one or more metal chlorides to form an intermediary product comprising carbon, metal, chloride, and oxygen. This intermediary product can be further processed by direct exposure to carbonate solutions to form a second intermediary product comprising carbon, metal carbonate, and oxygen. Either intermediary product may be further processed: a) in air to produce metal oxide; b) in an inert environment to produce metal oxide on carbon substrate; c) in a reducing environment to produce elemental metal distributed on carbon substrate. The product generally takes the shape of the carbon precursor.
Author
Metal Oxides; Carbon; Substrates; Graphite



19990109144 NASA Langley Research Center, Hampton, VA USA

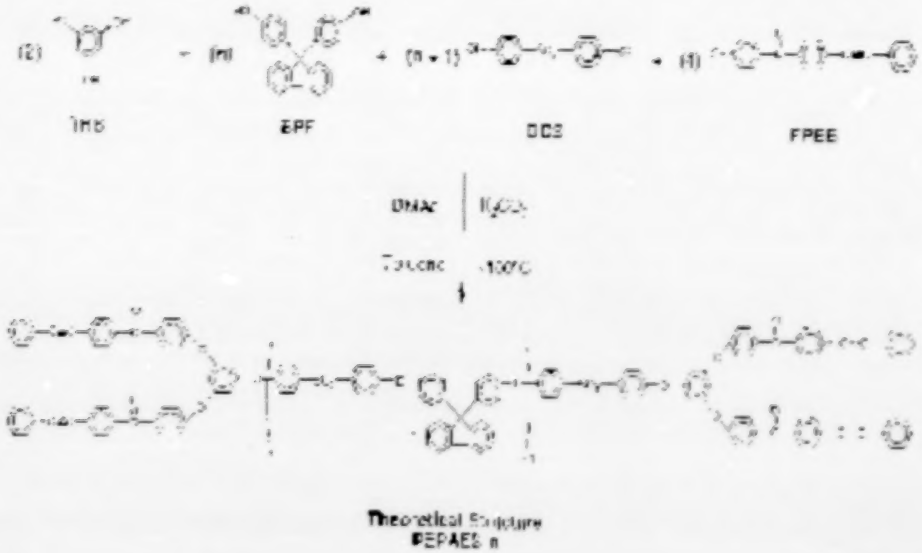
Method of Preparing Polymers with Low Melt Viscosity

Jensen, Brian J., Inventor, NASA Langley Research Center, USA; Oct. 12, 1999; In English; Division of US-Patent-Appl-SN-666793, filed 18 Jun. 1996 which is a continued-in-part of abandoned US-Patent-Appl-SN-622176, filed 5 Mar. 1996 Patent Info.: Filed 5 Jun. 1998; NASA-Case-LAR-15534-3; US-Patent-5,964,687; US-Patent-Appl-SN-092515; US-Patent-Appl-SN-666793; US-Patent-Appl-SN-622176; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

This invention is an improvement in standard polymerization procedures, i.e., addition-type and step-growth type polymerization, wherein monomers are reacted to form a growing polymer chain. The improvement includes employ- ing an effective amount of a trifunctional monomer (such as a trifunctional amine, anhydride, or phenol) in the polymerization procedure to form a mixture of polymeric materials consisting of branced polymers, star-shaped polymers, and linear polymers. This mixture of polymeric materials has a lower melt temperature and a lower melt viscosity than corresponding linear polymeric materials of equivalent molecular weight.

Official Gazette of the U.S. Patent and Trademark Office

Procedures; Polymerization; Polymers; Viscosity



32
COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications. For related information see also 04 Aircraft Communications and Navigation and 17 Space Communications, Spacecraft Communications, Command and Tracking. For search and rescue see 03 Air Transportation and Safety, and 16 Space Transportation.

19990106557 NASA Langley Research Center, Hampton, VA USA

Method and System for Producing Images of an Object

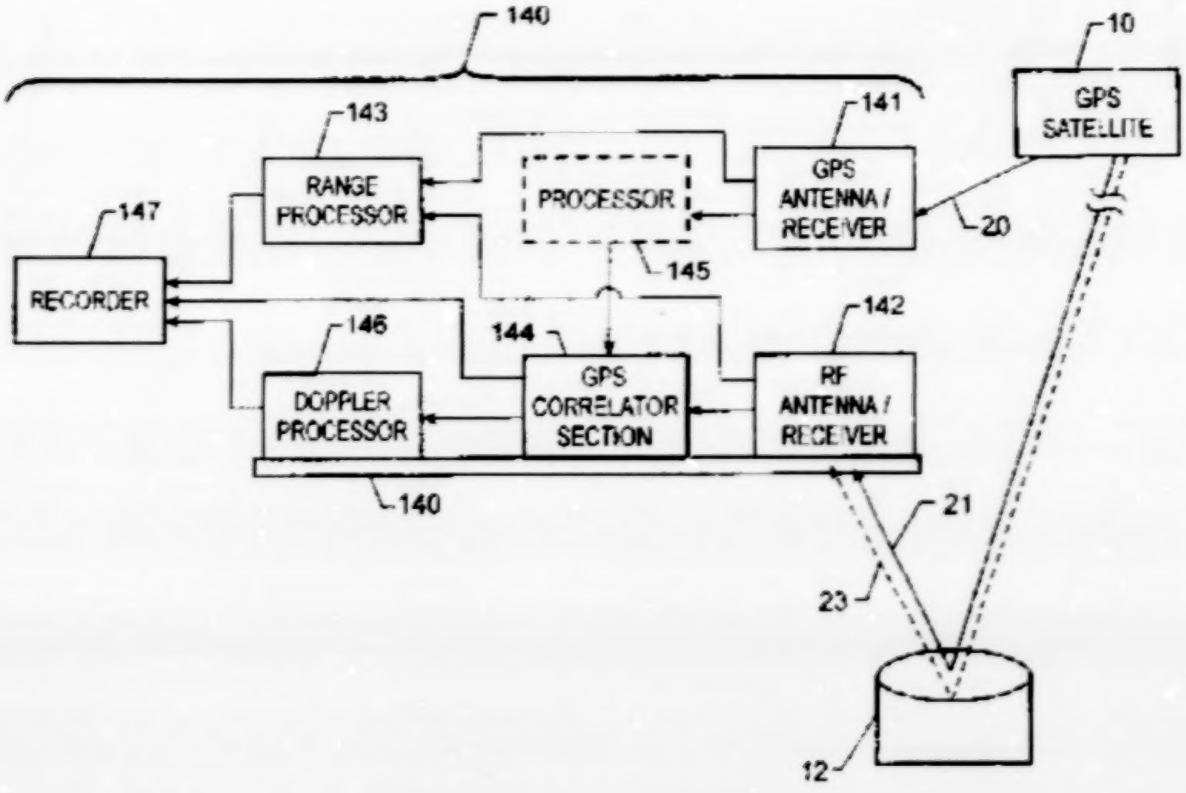
Katzberg, Stephen J., Inventor, NASA Langley Research Center, USA; Garrison, James L., Jr., Inventor, NASA Langley Research Center, USA; Sep. 07, 1999; In English

Patent Info.: Filed 6 Jan. 1998; NASA-Case-LAR-15538-1; US-Patent-5,949,364; US-Patent-Appl-SN-003247; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A method and system are provided to produce images of an object. A receiving station is positioned in view of a range-coded signal emitting satellite and the object. The receiving station is sensitive to direct transmission of the range-coded signal and reflections of the range-coded signal from the object. Both range from the receiving station to the object and a Doppler frequency shift

history between the receiving station and the object is determined using the direct transmission and reflections of the range-coded signal. An image is formed using the two-dimensional record provided by the range and the Doppler frequency shift history. Official Gazette of the U.S. Patent and Trademark Office

Signal Reflection; Doppler Effect; Imaging Techniques



33
ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry. For related information see also 60 Computer Operations and Hardware and 76 Solid-State Physics.

19990114985 NASA Pasadena Office, CA USA

Method Producing an SNS Superconducting Junction with Weak Link Barrier

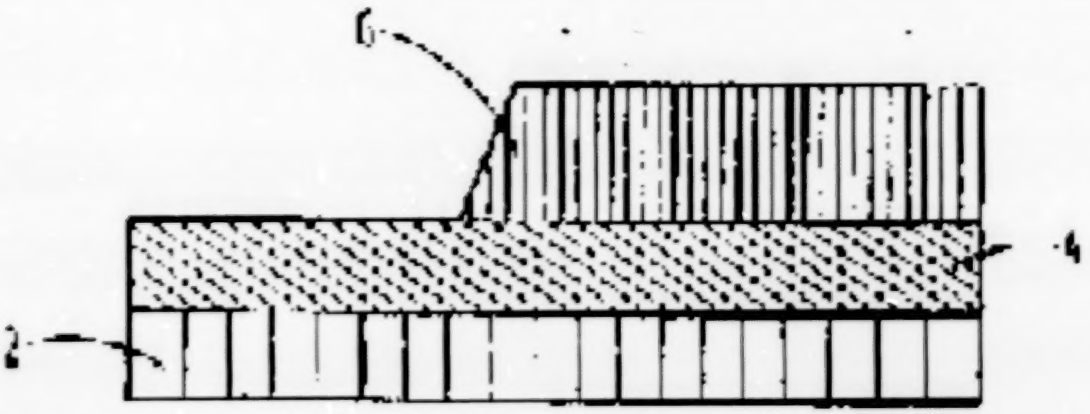
Hunt, Brian D., Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Aug. 31, 1999; In English

Patent Info.: Filed 19 Mar. 1992; NASA-Case-NPO-18552-1-CU; US-Patent-5,945,383; US-Patent-Appl-SN-8541[illegible]; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A method of producing a high temperature superconductor Josephson element and an improved SNS weak link barrier element is provided. A YBaCuO superconducting electrode film is deposited on a substrate at a temperature of approximately 800 C. A weak link barrier layer of a nonsuperconducting film of N-YBaCuO is deposited over the electrode at a temperature range of 520 C. to 540 C. at a lower deposition rate. Subsequently a superconducting counter-electrode film layer of YBaCuO is deposited over the weak link barrier layer at approximately 800 C. The weak link barrier layer has a thickness of approximately 50 A and the SNS element can be constructed to provide an edge geometry junction.

Author

Barrier Layers; Superconductivity; Josephson Junctions; YBCO Superconductors



34
FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling. For related information see also 02 Aerodynamics and 77 Thermodynamics and Statistical Physics.

19990109146 NASA Ames Research Center, Moffett Field, CA USA

Evaporative Cooling Membrane Device

Lomax, Curtis, Inventor, NASA Ames Research Center, USA; Moskito, John, Inventor, NASA Ames Research Center, USA; Sep. 07, 1999; In English

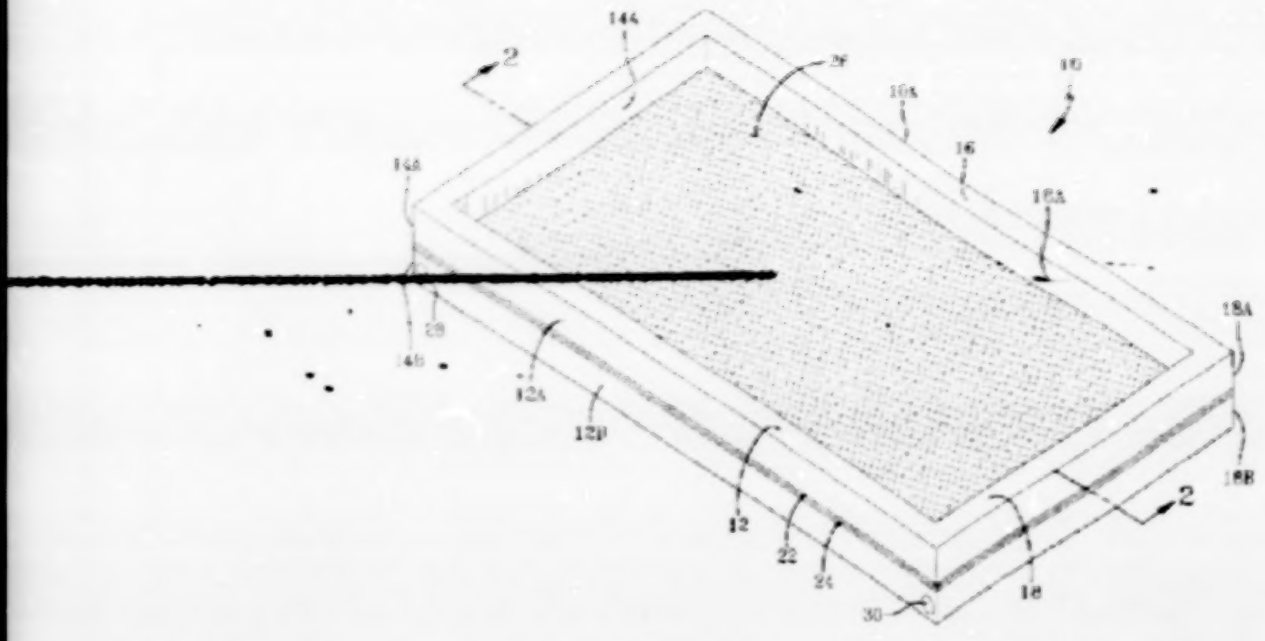
Patent Info.: Filed 25 Feb. 1998; NASA-Case-ARC-14176-1-LE; US-Patent-5,946,931; US-Patent-Appl-SN-030101; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

An evaporative cooling membrane device is disclosed having a flat or pleated plate housing with an enclosed bottom and an exposed top that is covered with at least one sheet of hydrophobic porous material having a thin thickness so as to serve as a membrane. The hydrophobic porous material has pores with predetermined dimensions so as to resist any fluid in its liquid state from passing therethrough but to allow passage of the fluid in its vapor state, thereby, causing the evaporation of the fluid and the cooling of the remaining fluid. The fluid has a predetermined flow rate. The evaporative cooling membrane device has a channel which is sized in cooperation with the predetermined flow rate of the fluid so as to produce laminar flow therein. The evaporative cooling

membrane device provides for the convenient control of the evaporation rates of the circulating fluid by adjusting the flow rates of the laminar flowing fluid.

Author

Evaporative Cooling; Membranes



35
INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see 43 Earth Resources and Remote Sensing. For related information see also 06 Aircraft Instrumentation, and 19 Space Instrumentation.

19990106558 NASA Langley Research Center, Hampton, VA USA

Cryogenic High Pressure Sensor Module

Chapman, John J., Inventor, NASA Langley Research Center, USA; Shams, Qamar A., Inventor, NASA Langley Research Center, USA; Powers, William T., Inventor, NASA Langley Research Center, USA; Sep. 21, 1999; In English; Division of US-Patent-Appl-SN-778065, filed 10 Dec. 1996 which is a continuation of US-Patent-Appl-SN-681245, filed 22 Jul. 1996

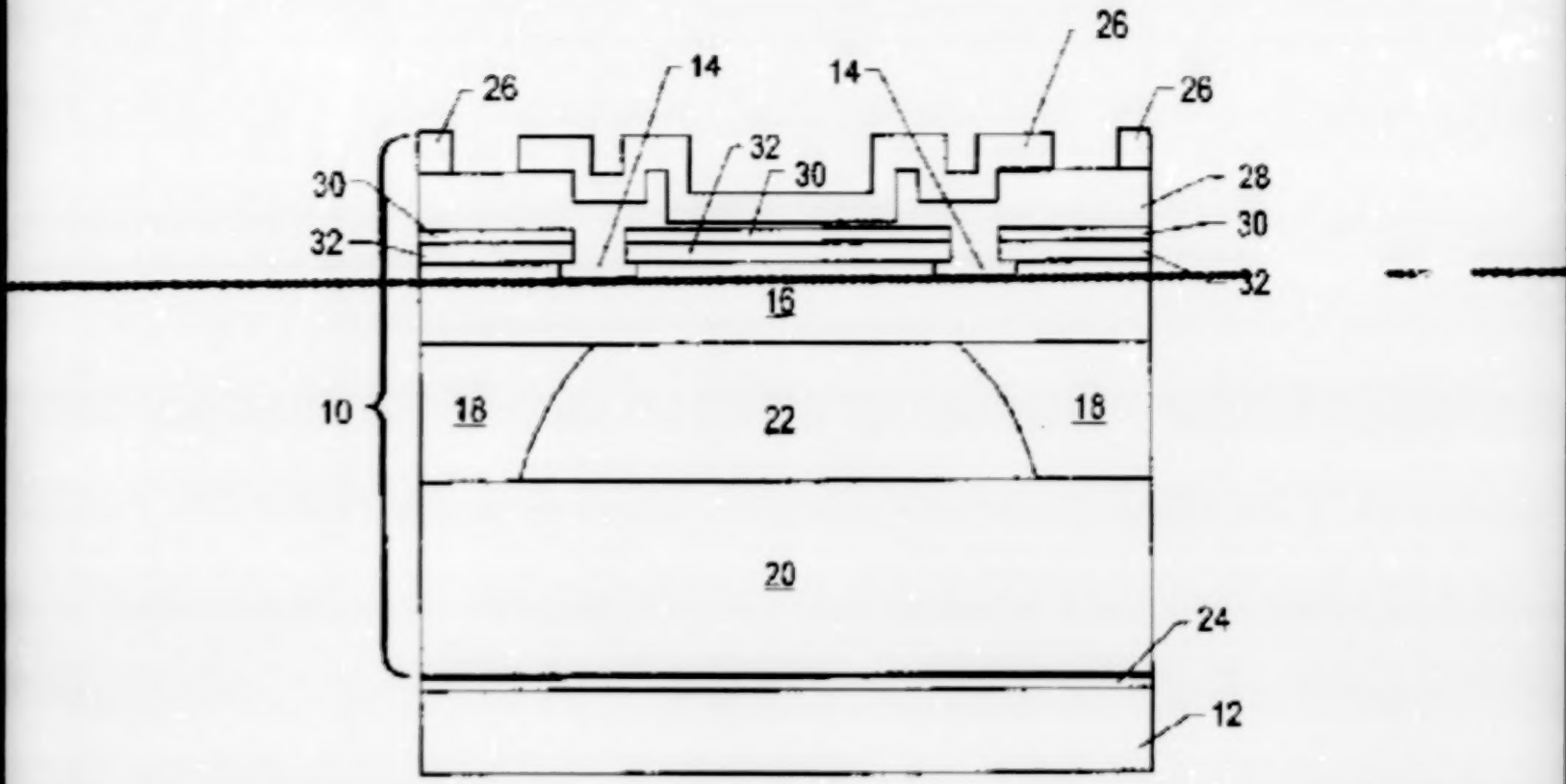
Patent Info.: Filed 18 Dec. 1997; NASA-Case-LAR-15280-3-SB; US-Patent-5,955,678; US-Patent-Appl-SN-992972; US-Patent-Appl-SN-778065; US-Patent-Appl-SN-681245; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A pressure sensor is provided for cryogenic, high pressure applications. A highly doped silicon piezoresistive pressure sensor is bonded to a silicon substrate in an absolute pressure sensing configuration. The absolute pressure sensor is bonded to an aluminum nitride substrate. Aluminum nitride has appropriate coefficient of thermal expansion for use with highly doped silicon at

cryogenic temperatures. A group of sensors, either two sensors on two substrates or four sensors on a single substrate are packaged in a pressure vessel.

Official Gazette of the U.S. Patent and Trademark Office

Pressure Sensors; Cryogenic Temperature; Pressure Vessels; Aluminum Nitrides



19990108571 NASA Langley Research Center, Hampton, VA USA

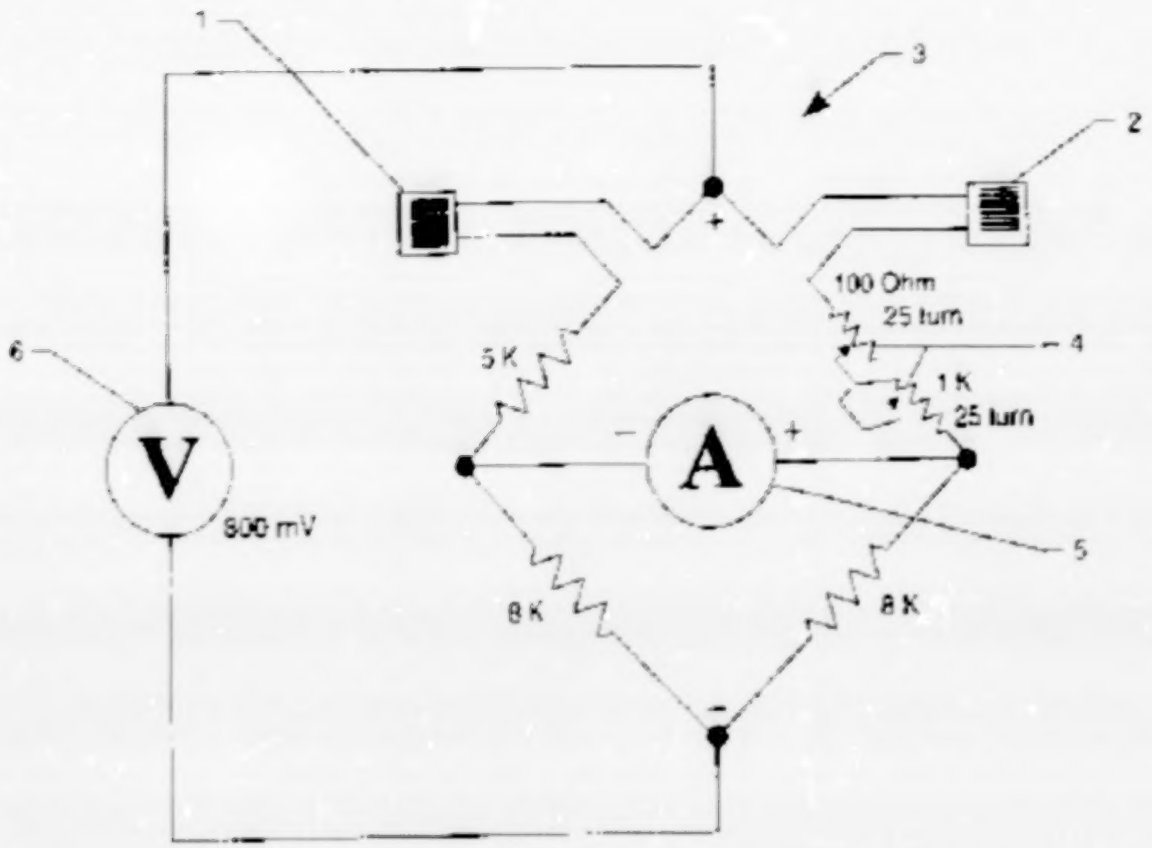
Solid State Carbon Monoxide Sensor

Upchurch, Billy T., Inventor, NASA Langley Research Center, USA; Wood, George M., Inventor, NASA Langley Research Center, USA; Schryer, David R., Inventor, NASA Langley Research Center, USA; Leighty, Bradley D., Inventor, NASA Langley Research Center, USA; Oglesby, Donald M., Inventor, NASA Langley Research Center, USA; Kielin, Erik J., Inventor, NASA Langley Research Center, USA; Brown, Kenneth G., Inventor, NASA Langley Research Center, USA; DAmbrosia, Christine M., Inventor, NASA Langley Research Center, USA; Sep. 07, 1999; In English; Provisional US-Patent-Appl-SN-016669, filed 1 May 1996

Patent Info.: Filed 28 Apr. 1997; NASA-Case-LAR-15525-1-CU; US-Patent-5,948,965; US-Patent-Appl-SN-845899; US-Patent-Appl-SN-016669; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A means for detecting carbon monoxide which utilizes an un-heated catalytic material to oxidize carbon monoxide at ambient temperatures. Because this reaction is exothermic, a thermistor in contact with the catalytic material is used as a sensing element to detect the heat evolved as carbon monoxide is oxidized to carbon dioxide at the catalyst surface, without any heaters or external heating elements for the ambient air or catalytic element material. Upon comparison to a reference thermistor, relative increases

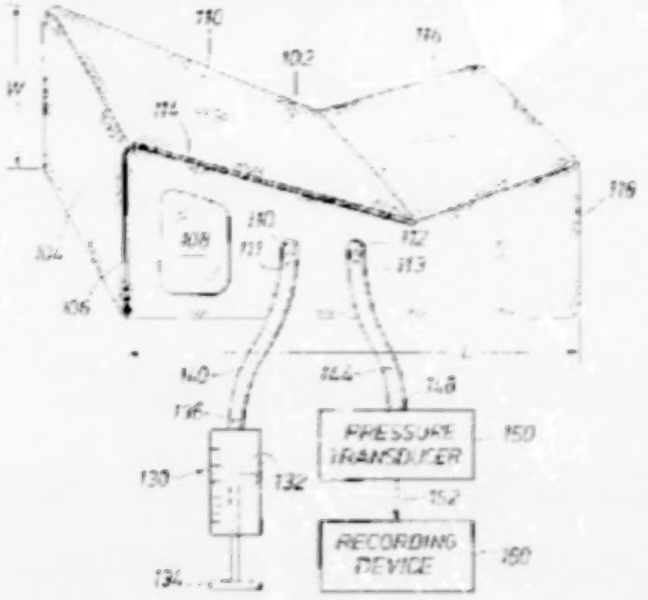
in the temperature of the sensing thermistor correspond positively with an increased concentration of carbon monoxide in the ambient medium and are thus used as an indicator of the presence of carbon monoxide.
Author
Solid State; Carbon Monoxide; Gas Detectors; Thermistors



19990109145 NASA Johnson Space Center, Houston, TX USA
Soft-Sided Air Displacement Volumometer
Siconolfi, Steven F., Inventor, NASA Johnson Space Center, USA; Sep. 07, 1999; In English
Patent Info.: Filed 31 Mar. 1998; NASA-Case-MSC-22653-1; US-Patent-5,948,977; US-Patent-Appl-SN-054311; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

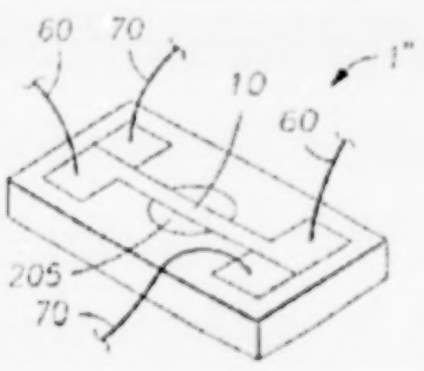
A soft-sided air displacement volumometer includes a soft-sided bag, an air injector, a pressure transducer, and a recording device. The soft-sided volumometer is used to measure the total body volume of a person or the volume of one limb of a person. After the person enters the soft-sided bag, the bag is sealed and pressurized to a predetermined level using the air injector. The pressure inside the soft-sided bag is continuously monitored using the pressure transducer and recording device while the volume of the soft-side bag is incrementally reduced. The elasticity of the soft-sided bag is eliminated from the volume calculations by operating the soft-sided air displacement volumometer over a relatively small range of volumes and pressures in which the elastic-

ity is substantially constant. The volume of the person inside the soft-sided bag is calculated as the volume of the empty bag (i.e. without a person) minus the initial volume of the bag with the person pressurized to an initial pressure level.
Author
Volumetric Analysis; Body Volume (Biology); Human Beings; Air; Displacement; Level (Quantity)



19990110314 NASA Johnson Space Center, Houston, TX USA
Method of Manufacturing a Micromechanical Oscillating Mass Balance
Altemir, David A., Inventor, NASA Johnson Space Center, USA Sep. 07, 1999; In English; Division of US-Patent-Appl-SN-587762, filed 12 Dec. 1995
Patent Info.: Filed 24 Jul. 1997; NASA-Case-MSC22569-2; US-Patent-5,946,795; US-Patent-Appl-SN-910537; US-Patent-Appl-SN-587762; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A micromechanical oscillating mass balance and method adapted for measuring minute quantities of material deposited at a selected location, such as during a vapor deposition process. The invention comprises a vibratory composite beam which includes a dielectric layer sandwiched between two conductive layers.The beam is positioned in a magnetic field. An alternating current passes through one conductive layers, the beam oscillates, inducing an output current in the second conductive layer, which is analyzed to determine the resonant frequency of the beam. As material is deposited on the beam, the mass of the beam increases and the resonant frequency of the beam shifts, and the mass added is determined.
Author
Manufacturing; Micromechanics; Oscillations; Mass Distribution; Balance



37
MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

19990104278 NASA Johnson Space Center, Houston, TX USA

Torque-Limiting Manipulation Device

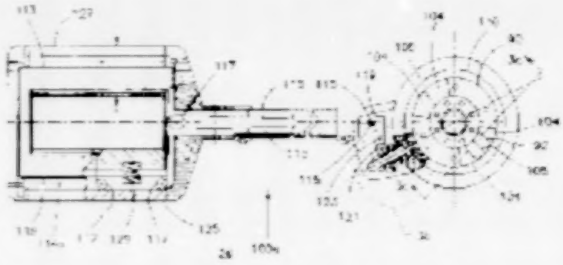
Moetteli, John B., Inventor, NASA Johnson Space Center, USA; Jul. 20, 1999; In English

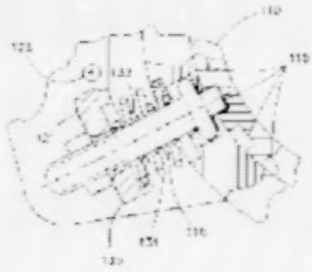
Patent Info.: Filed 28 Jan. 1997; NASA-Case-MSC-22595-1; US-Patent-5,924,329; US-Patent-Appl-SN-789259; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

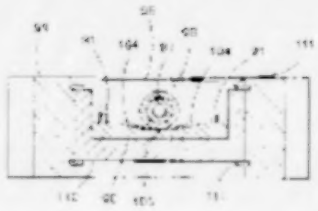
A device for manipulating a workpiece in space includes a fixture, a stanchion assembly, a manipulation mechanism, an actuation mechanism, and a reaction mechanism. The fixture has an end onto which the workpiece affixes. The stanchion assembly has an upper and a lower end. The manipulation mechanism connects the fixture and the upper end of the stanchion assembly. The lower end of the stanchion assembly mounts, via probe and a socket, to a structure. The actuation mechanism operably connects to the manipulation mechanism, and moves the fixture in space. The reaction mechanism provides a point through which force inputs into the actuation mechanism may react.

Author

Torque; Torque Sensors (Robotics); Manipulators; Control Equipment; End Effectors; Actuators







19990104285 NASA Langley Research Center, Hampton, VA USA

Carbon Fiber Reinforced Carbon Composite Valve for an Internal Combustion Engine

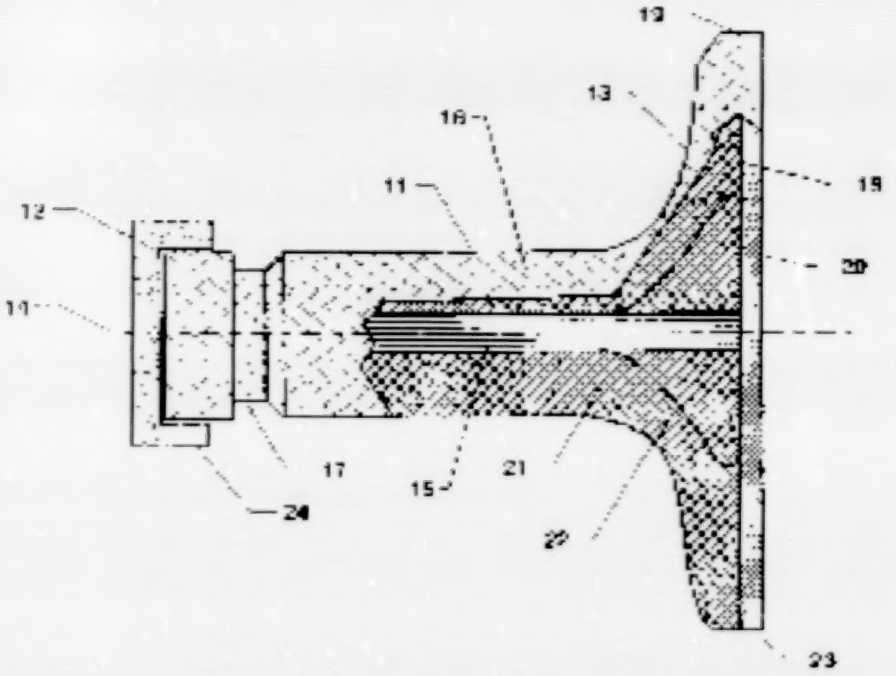
Rivers, H. Kevin, Inventor, NASA Langley Research Center, USA; Ransone, Philip O., Inventor, NASA Langley Research Center, USA; Northam, G. Burton, Inventor, NASA Langley Research Center, USA; Aug. 10, 1999; In English

Patent Info.: Filed 12 Mar. 1997; NASA-Case-LAR-15274-1; US-Patent-5,934,648; US-Patent-Appl-SN-828818; US-Patent-Appl-SN-014188; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A carbon fiber reinforced carbon composite valve for internal combustion engines and the like formed of continuous carbon fibers throughout the valve's stem and head is disclosed. The valve includes braided carbon fiber material over axially aligned unidirectional carbon fibers forming a valve stem; the braided and unidirectional carbon fibers being broomed out at one end of the valve stem forming the shape of the valve head; the valve-shaped structure being densified and rigidized with a matrix of carbon containing discontinuous carbon fibers; and the finished valve being treated to resist oxidation. Also disclosed is a carbon matrix plug containing continuous and discontinuous carbon fibers and forming a net-shape valve head acting as a mandrel over which the unidirectional and braided carbon fibers are formed according to textile processes. Also disclosed are various preform valves and processes for making finished and preform carbon fiber reinforced carbon composite valves.

Official Gazette of the U.S. Patent and Trademark Office

Carbon-Carbon Composites; Reinforcing Fibers; Valves; Plugs



19990105707 NASA Langley Research Center, Hampton, VA USA

Lightweight Exhaust Manifold and Exhaust Pipe Ducting for Internal Combustion Engines

Northam, G. Burton, Inventor, NASA Langley Research Center, USA; Ransone, Philip O., Inventor, NASA Langley Research Center, USA; Rivers, H. Kevin, Inventor, NASA Langley Research Center, USA; Jul. 27, 1999; In English; Provisional US-Patent-Appl-SN-012939, filed 6 Mar. 1996

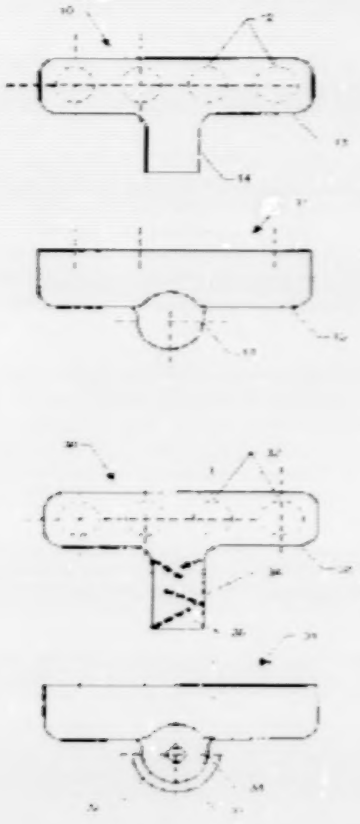
Patent Info.: Filed 5 Mar. 1997; NASA-Case-LAR-15497-1; US-Patent-5,927,070; US-Patent-Appl-SN-816404; US-Patent-Appl-SN-012939; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

An improved exhaust system for an internal combustion gasoline-and/or diesel-fueled engine includes an engine exhaust manifold which has been fabricated from carbon- carbon composite materials in operative association with an exhaust pipe ducting which has been fabricated from carbon-carbon composite materials. When compared to conventional steel, cast iron, or ceramic-lined iron paris, the use of carbon-carbon composite exhaust-gas manifolds and exhaust pipe ducting reduces the overall weight of the engine, which allows for improved acceleration and fuel efficiency; permits operation at higher temperatures without a loss of strength; reduces the "through-the wall" heat loss, which increases engine cycle and turbocharger efficiency and ensures faster

"light-off" of catalytic converters; and, with an optional thermal reactor, reduces emission of major pollutants, i.e. hydrocarbons and carbon monoxide.

Official Gazette of the U.S. Patent and Trademark Office

Exhaust Systems; Diesel Engines; Internal Combustion Engines; Exhaust Gases; Contaminants; Carbon-Carbon Composites



19990108572 NASA Johnson Space Center, Houston, TX USA

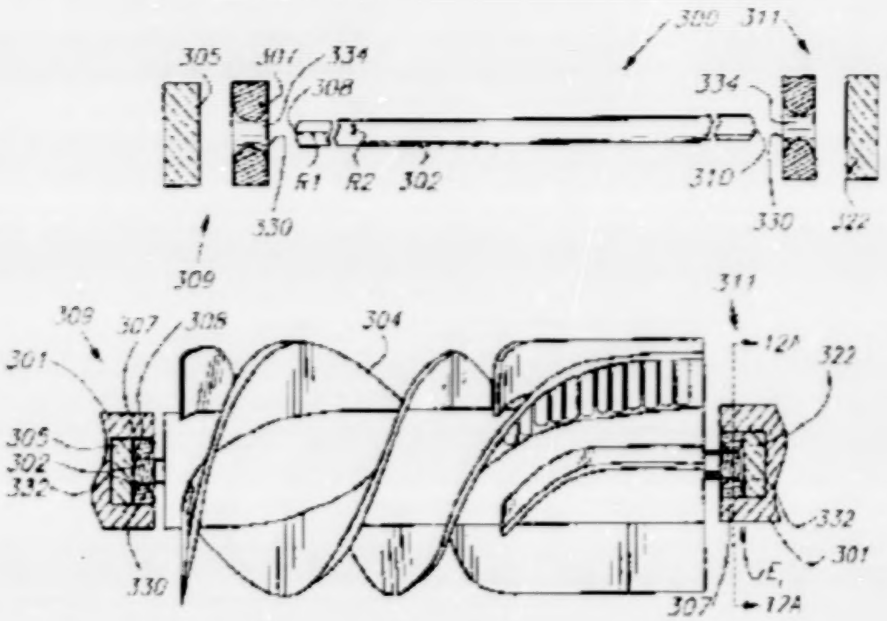
Blood Pump Bearing System

Aber, Gregory S., Inventor, NASA Johnson Space Center, USA; Sep. 28, 1999; In English; Continuation-in-part of US-Patent-Appl-SN-153595, filed 10 Nov. 1993 and continuation-in-part of US-Patent-Appl-SN-451709, filed 26 May 1995

Patent Info.: Filed 17 Jun. 1996; NASA-Case-MSC-22721-1; US-Patent-5,957,672; US-Patent-Appl-SN-664579; US-Patent-Appl-SN-153595; US-Patent-Appl-SN-451709; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

Methods and apparatus are provided for a blood pump bearing system within a pump housing to support long-term high-speed rotation of a rotor with an impeller blade having a plurality of individual magnets disposed thereon to provide a small radial air gap between the magnets and a stator of less than 0.025 inches. The bearing system may be mounted within a flow straightener, diffuser, or other pump element to support the shaft of a pump rotor. The bearing system includes a zirconia shaft having a radiused end. The radiused end has a first radius selected to be about three times greater than the radius of the zirconia shaft. The radiused end of the zirconia shaft engages a flat sapphire endstone. Due to the relative hardness of these materials a flat is quickly produced during break-in on the zirconia radiused end of precisely the size necessary to support thrust loads whereupon wear substantially ceases. Due to the selection of the first radius, the change in shaft end-play during pump break-in is limited to a total desired end-play of less than about 0.010 inches. Radial loads are supported by an olive hole ring jewel that makes near line contact around the circumference of the shaft to support high speed rotation with little friction. The width of olive hole ring jewel is small to allow

heat to conduct through to thereby prevent heat build-up in the bearing. A void defined by the bearing elements may fill with blood that then coagulates within the void. The coagulated blood is then conformed to the shape of the bearing surfaces.
Author
Blood; Blood Pumps; Bearings; Axial Flow; Radial Flow



38
QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

19990104280 NASA Langley Research Center, Hampton, VA USA
Radially Focused Eddy Current Sensor for Detection of Longitudinal Flaws in Metallic Tubes
Wincheski, Russell A., Inventor, NASA Langley Research Center, USA; Simpson, John W., Inventor, NASA Langley Research Center, USA; Fulton, James P., Inventor, NASA Langley Research Center, USA; Nath, Shridhar C., Inventor, NASA Langley Research Center, USA; Todhunter, Ronald G., Inventor, NASA Langley Research Center, USA; Namkung, Min, Inventor, NASA Langley Research Center, USA; Aug. 24, 1999; In English
Patent Info.: Filed 13 Sep. 1995; NASA-Case-LAR-15330-1; US-Patent-5,942,894; US-Patent-Appl-SN-527741; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A radially focused eddy current sensor detects longitudinal flaws in a metal tube. A drive coil induces eddy currents within the wall of the metal tube. A pick-up cod is spaced apart from the drive coil along the length of the metal tube. The pick@ up coil is positioned with one end thereof lying adjacent the wall of the metal tube such that the pick-up coil's longitudinal axis is perpendicular to the wall of the metal tube, to isolate the pick-up coil from the magnetic flux of the drive coil and the flux from the induced eddy currents, except the eddy currents diverted by a longitudinal flaw, an electrically conducting material high in magnetic

permeability surrounds all of the pick-up coil except its one end that is adjacent the walls of the metal tube. The electrically conducting material can extend into and through the drive coil in a coaxial relationship therewith.

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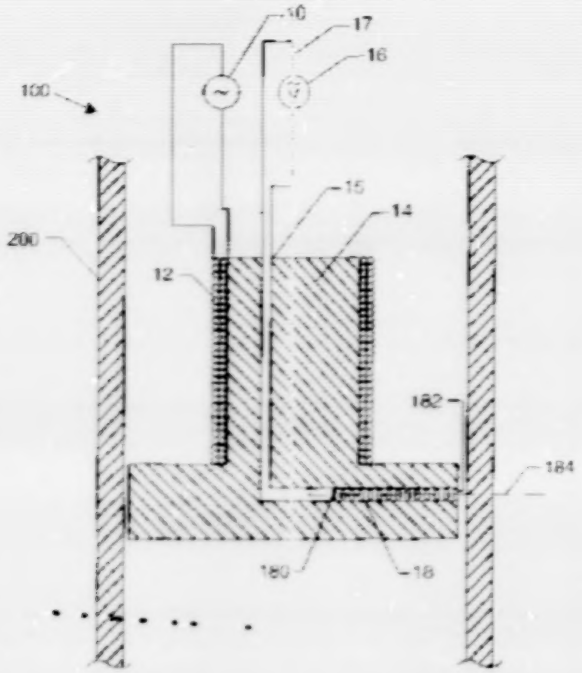
Eddy Currents; Magnetic Flux; Focusing; Charge Flow Devices



51
LIFE SCIENCES (GENERAL)

19990108575 NASA Johnson Space Center, Houston, TX USA

Three Dimensional Optic Tissue Culture and Process

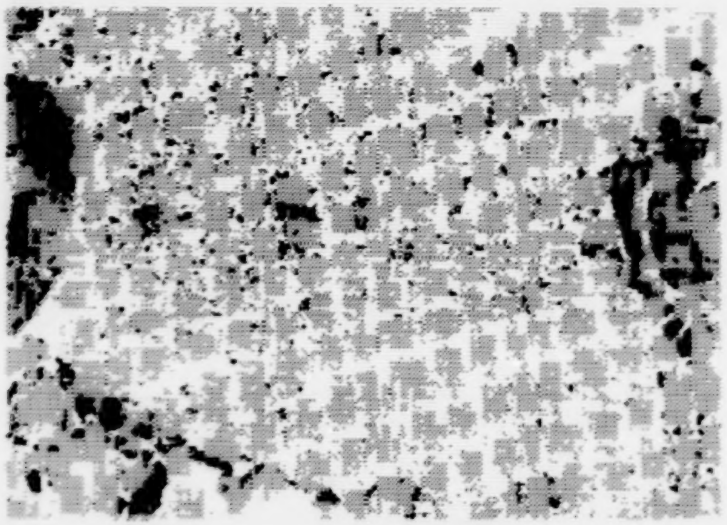
OConnor, Kim C., Inventor, NASA Johnson Space Center, USA; Spaulding, Glenn F., Inventor, NASA Johnson Space Center, USA; Goodwin, Thomas J., Inventor, NASA Johnson Space Center, USA; Aten, Laurie A., Inventor, NASA Johnson Space Center, USA; Francis, Karen M., Inventor, NASA Johnson Space Center, USA; Caldwell, Delmar R., Inventor, NASA Johnson Space Center, USA; Prewett, Tacey L., Inventor, NASA Johnson Space Center, USA; Fitzgerald, Wendy S., Inventor, NASA Johnson Space Center, USA; Oct. 05, 1999; In English; Continuation-in-part of US-Patent-Appl-SN-066292, filed 25 May 1993, US-Patent-Appl-SN-939791, filed 3 Sep. 1992, US-Patent-Appl-SN-317931, US-Patent-Appl-SN-317776, US-Patent-Appl-SN-213588, US-Patent-Appl-SN-213559, US-Patent-Appl-SN-625345

Patent Info.: Filed 13 May 1994; NASA-Case-MSC-223684; US-Patent-5,962,324; US-Patent-Appl-SN-242546; US-Patent-Appl-SN-066292; US-Patent-Appl-SN-939791; US-Patent-Appl-SN-317931; US-Patent-Appl-SN-153132; US-Patent-Appl-SN-317776; US-Patent-Appl-SN-213588; US-Patent-Appl-SN-213559; US-Patent-Appl-SN-625345; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A process for artificially producing three-dimensional optic tissue has been developed. The optic cells are cultured in a bioreactor at low shear conditions. The tissue forms as normal, functional tissue grows with tissue organization and extracellular matrix formation.

Official Gazette of the U.S. Patent and Trademark Office

Three Dimensional Models; Tissues (Biology); Cells



63
CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems. For related information see also 54 Man/System Technology and Life Support.

19990104276 NASA Pasadena Office, CA USA

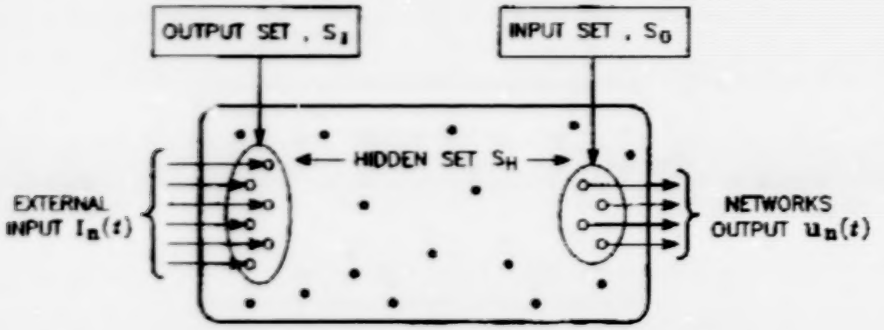
Neural Network Training by Integration of Adjoint Systems of Equations Forward in Time

Toomarian, Nikzad, Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Barhen, Jacob, Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Jul. 27, 1999; In English

Patent Info.: Filed 27 Oct. 1992; NASA-Case-NPO-18586-1-CU; US-Patent-5,930,781; US-Patent-Appl-SN-969868; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A method and apparatus for supervised neural learning of time dependent trajectories exploits the concepts of adjoint operators to enable computation of the gradient of an objective functional with respect to the various parameters of the network architecture in a highly efficient manner. Specifically, it combines the advantage of dramatic reductions in computational complexity inherent in adjoint methods with the ability to solve two adjoint systems of equations together forward in time. Not only is a large amount of computation and storage saved, but the handling of real-time applications becomes also possible. The invention has been applied it to two examples of representative complexity which have recently been analyzed in the open literature and demonstrated that a circular trajectory can be learned in approximately 200 iterations compared to the 12000 reported in the literature.

A figure eight trajectory was achieved in under 500 iterations compared to 20000 previously required. The trajectories computed using our new method are much closer to the target trajectories than was reported in previous studies.
Author
Neural Nets; Belief Networks; Artificial Intelligence; Education; Transfer of Training



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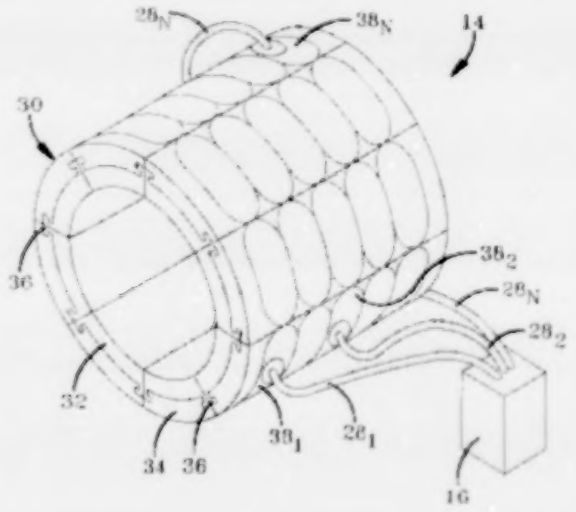
OPTICS

Includes light phenomena and optical devices. For lasers see 36 Lasers and Masers.

19990104279 NASA Lewis Research Center, Cleveland, OH USA
Optical Power Source Derived from Engine Combustion Chambers
Baumbick, Robert J., Inventor, NASA Lewis Research Center, USA; Jul. 13, 1999; In English
Patent Info.: Filed 2 Feb. 1998; NASA-Case-LEW-16542-1; US-Patent-5,923,809; US-Patent-Appl-SN-040194; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

An optical power source is disclosed that collects the spectra of the light emissions created in a combustion chamber to provide its optical output signals that serve the needs of optical networks. The light spectra is collected by a collection ring serving as an optical waveguide.
Author
Optical Waveguides; Light Beams; Light Emission; Laser Outputs; Optical Communication



Subject Term Index

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Personal Author Index

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Inquiries concerning the NASA Patent Licensing Program or the availability of licenses for the commercial use of NASA-owned inventions covered by U.S. patents or pending applications for patent should be forwarded to the NASA Patent Counsel of the NASA installation having cognizance of the specific invention, or the Associate General Counsel for Intellectual Property, code GP, National Aeronautics and Space Administration, Washington, D.C. 20546. Inquiries should refer to the NASA Case Number, the Title of the Invention, and the U.S. Patent Number or the U.S. Application Serial Number assigned to the invention as shown in this bibliography.

The NASA Patent Counsel having cognizance of the invention is determined by the first three letters or prefix of the NASA Case Number assigned to the invention. The addresses of NASA Patent Counsels are listed alongside the NASA Case Number prefix letters in the following table.

NASA Case Number Prefix Letters	Address of Cognizant NASA Patent Counsel
ARC-xxxxx XAR-xxxxx	Ames Research Center Mail Code: 200-11A Moffett Field, California 94035 Telephone: (415) 694-5104
ERC-xxxx XER-xxxxx HQN-xxxxx XHQ-xxxxx	NASA Headquarters Mail Code: GP Washington, DC 20546 Telephone: (202) 358-2066
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NPO-xxxxx XNP-xxxxx DRC-xxxxx FRC-xxxxx XFR-xxxxx WOO-xxxxx	NASA Resident Legal Office Mail Code: 180-801 4800 Oak Grove Drive Pasadena, California 91103 Telephone: (818) 354-2700
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PATENT LICENSING REGULATIONS

NATIONAL AERONAUTICS AND SPACE ADMINITRATION
14 CFR Part 1245
Patents and Other Intellectual Property Rights

AGENCY: National Aeronautics and Space Administration (NASA).

Action: Final rule.

SUMMARY: NASA is amending 14 CFR Part 1245 by removing Subpart 2, "Licensing of NASA Inventions." The Department of Commerce has issued similar regulations which prescribe the terms, conditions, and procedures upon which a federally-owned invention may be licensed. These regulations are codified at 37 CFR Part 404, *"Licensing of Government Owned Inventions."* NASA began granting licenses in accordance with the Department of Commerce regulations on March 13, 1995. All licenses agreements executed prior to this date will operate under the previous regulations.

EFFECTIVE DATE: March 13, 1995.

FOR FURTHER INFORMATION CONTACT:
John G. Mannix, (202) 358-2424.

List of Subjects in 14 CFR Part 1245
Authority delegations (Government agencies), Inventions and patents.

Under the authority, 42 U.S.C. 2473, 14 CFR Part 1245 is amended as follows:

PART 1245 — [AMENDED]

Subpart 2 — [Removed and Reserved]

In 14 CFR Part 1245, Subpart 2 (consisting of SS 1245.200 through 1245.214) is removed and reserved.

Dated: April 24,1995.

Edward A. Frankle,
General Counsel.

[FR Doc. 95 10583 Filed 4 28 95 8:45 am]

BILLING CODE 7510 01 M

Code of Federal Regulations 37
CFR Part 404
Licensing of Government Owned Inventions

Sec.

Sec. 404.1 Scope of part.
This part prescribes the terms, conditions, and procedures upon which a federally owned invention, other than an invention in the custody of the Tennessee Valley Authority, may be licensed. It supersedes the regulations at 41 CFR Subpart 101–4.1. This part does not affect licenses which (a) were in effect prior to July 1, 1981; (b) may exist at the time of the Government's acquisition of title to the invention, including those resulting from the allocation of rights to inventions made under Government research and development contracts; (c) are the result of an authorized exchange of rights in the settlement of patent disputes; or (d) are otherwise authorized by law or treaty.

Sec. 404.2 Policy and objective.
It is the policy and objective of this subpart to use the patent system to promote the utilization of inventions arising from federally supported research or development.

Sec. 404.3 Definitions.
(a) *"Federally owned invention"* means an invention, plant, or design which is covered by a patent, or patent application in the United States, or a patent, patent application, plant variety protection, or other form of protection, in a foreign country, title to which has been assigned to or otherwise vested in the United States Government.

(b) *"Federal agency"* means an executive department, military department, Government corporation, or independent establishment, except the Tennessee Valley Authority, which has custody of a federally owned invention.

(c) *"Small business firm"* means a small business concern as defined in section 2 of Pub. L. 85–536 (15 U.S.C. 632) and implementing regulations of the Administrator of the Small Business Administration.

(d) *"Practical application"* means to manufacture in the case of a composition or product, to practice in the case of a process or method, or to operate in the case of a machine or system; and, in each case, under such conditions as to establish that the invention is being utilized and that its benefits are to the extent permitted by law or Government regulations available to the public on reasonable terms.

(e) *"United States"* means the United States of America, its territories and possessions, the District of Columbia, and the Commonwealth of Puerto Rico.

Sec. 404.4 Authority to grant licenses.
Federally owned inventions shall be made available for licensing as deemed appropriate in the public interest. Federal agencies having custody of federally owned inventions may grant nonexclusive, partially exclusive, or exclusive licenses thereto under this part.

Sec. 404.5 Restrictions and conditions on all licenses granted under this part.
(a) (1) A license may be granted only if the applicant has supplied the Federal agency with a satisfactory plan for development or marketing of the invention, or both, and with information about the applicant's capability to fulfill the plan.

(2) A license granting rights to use or sell under a federally owned invention in the United States shall normally be granted only to a licensee who agrees that any products embodying the invention or produced through the use of the invention will be manufactured substantially in the United States.

(b) Licenses shall contain such terms and conditions as the Federal agency determines are appropriate for the protection of the interests of the Federal Government and the public and are not in conflict with law or this part. The following terms and conditions apply to any license:

(1) The duration of the license shall be for a period specified in the license agreement unless sooner terminated in accordance with this part.

(2) The license may be granted for all or less than all fields of use of the invention or in specified geographical areas, or both.

(3) The license may extend to subsidiaries of the licensee or other parties if provided for in the license but shall be nonassignable without approval of the Federal agency, except to the successor of that part of the licensee's business to which the invention pertains.

(4) The licensee may provide the license the right to grant sublicenses under the license, subject to the approval of the Federal agency. Each sublicense shall make reference to the license, including the rights retained by the Government, and a copy of such sublicense shall be furnished to the Federal agency.

(5) The license shall require the licensee to carry out the plan for development or marketing of the invention, or both, to bring the invention to practical application within a period specified in the license, and to continue to make the benefits of the invention reasonably accessible to the public.

(6) The license shall require the licensee to report periodically on the utilization or efforts at obtaining utilization that are being made by the licensee, with particular reference to the plan submitted.

(7) Licenses may be royalty-free or for royalties or other consideration.

(8) Where an agreement is obtained pursuant to Sec. 404.5(a) (2) that any products embodying the invention or produced through use of the invention will be manufactured substantially in the United States, the license shall recite such agreement.

(9) The license shall provide for the right of the Federal agency to terminate the license, in whole or in part, if:

(i) The Federal agency determines that the licensee is not executing the plan submitted with its request for a license and the licensee cannot otherwise demonstrate to the satisfaction of the Federal agency that it has taken or can be expected to take within a reasonable time effective steps to achieve practical application of the invention;

(ii) The Federal agency determines that such action is necessary to meet requirements for public use specified by Federal regulations issued after the date of the license and such requirements are not reasonably satisfied by the licensee;

(iii) The licensee has willfully made a false statement of or willfully omitted a material fact in the license application or in any report required by the license agreement; or

(iv) The licensee commits a substantial breach of a covenant or agreement contained in the license.

(10) The license may be modified or terminated, consistent with this part, upon mutual agreement of the Federal agency and the licensee.

(11) Nothing relating to the grant of a license, nor the grant itself, shall be construed to confer upon any person any immunity from or defenses under the antitrust laws or from a charge of patent misuse, and the acquisition and use of rights pursuant to this part shall not be immunized from the operation of state or Federal law by reason of the source of the grant.

Sec. 404.6 Nonexclusive licenses.

(a) Nonexclusive licenses may be granted under federally owned inventions without publication of availability or notice of a prospective license.

(b) In addition to the provisions of Sec. 404.5, the nonexclusive license may also provide that, after termination of a period specified in the license agreement, the Federal agency may restrict the license to the fields of use or geographic areas, or both, in which the licensee has brought the invention to practical application and continues to make the benefits of the invention reasonably accessible to the public. However, such restriction shall be made only in order to grant an exclusive or partially exclusive license in accordance with this subpart.

Sec. 404.7 Exclusive and partially exclusive licenses.

(a) (1) Exclusive or partially exclusive domestic licenses may be granted on federally owned inventions three months after notice of the invention's availability has been announced in the Federal Register, or without such notice where the Federal agency determines that expeditious granting of such a license will best serve the interest of the Federal Government and the public; and in either situation, only if:

(i) Notice of a prospective license, identifying the invention and the prospective licensee, has been published in the Federal Register, providing opportunity for filing written objections within a 60-day period;

(ii) After expiration of the period in Sec. 404.7(a)(1)(i) and consideration of any written objections received during the period, the Federal agency has determined that:

(A) The interests of the Federal Government and the public will best be served by the proposed license, in view of the applicant's intentions, plans, and ability to bring the invention to practical application or otherwise promote the invention's utilization by the public;

(B) The desired practical application has not been achieved, or is not likely expeditiously to be achieved, under any nonexclusive license which has been granted, or which may be granted, on the invention;

(C) Exclusive or partially exclusive licensing is a reasonable and necessary incentive to call forth the investment of risk capital and expenditures to bring the invention to practical application or otherwise promote the invention's utilization by the public; and

(D) The proposed terms and scope of exclusivity are not greater than reasonably necessary to provide the incentive for bringing the invention to practical application or otherwise promote the invention's utilization by the public;

(iii) The Federal agency has not determined that the grant of such license will tend substantially to lessen competition or result in undue concentration in any section of the country in any line of commerce to which the technology to be licensed relates, or to create or maintain other situations inconsistent with the antitrust laws; and

(iv) The Federal agency has given first preference to any small business firms submitting plans that are determined by the agency to be within the capabilities of the firms and as equally likely, if executed, to bring the invention to practical application as any plans submitted by applicants that are not small business firms.

(2) In addition to the provisions of Sec. 404.5, the following terms and conditions apply to domestic exclusive and partially exclusive licenses:

(i) The license shall be subject to the irrevocable, royalty-free right of the Government of the United States to practice and have practiced the invention on behalf of the United States and on behalf of any foreign government or international organization pursuant to any existing or future treaty or agreement with the United States.

(ii) The license shall reserve to the Federal agency the right to require the licensee to grant sublicenses to responsible applicants, on reasonable terms, when necessary to fulfill health or safety needs.

(iii) The license shall be subject to any licenses in force at the time of the grant of the exclusive or partially exclusive license.

(iv) The license may grant the licensee the right of enforcement of the licensed patent pursuant to the provisions of Chapter 29 of Title 35, United States Code, or other statutes, as determined appropriate in the public interest.

(b) (1) Exclusive or partially exclusive licenses may be granted on a federally owned invention covered by a foreign patent, patent application, or other form of protection, provided that:

(i) Notice of a prospective license, identifying the invention and prospective licensee, has been published in the Federal Register, providing opportunity for filing written objections within a 60-day period and following consideration of such objections;

ment or United States industry in foreign commerce will be enhanced; and

(iii) The Federal agency has not determined that the grant of such license will tend substantially to lessen competition or result in undue concentration in any section of the United States in any line of commerce to which the technology to be licensed relates, or to create or maintain other situations inconsistent with antitrust laws.

(2) In addition to the provisions of Sec. 404.5 the following terms and conditions apply to foreign exclusive and partially exclusive licenses:

(i) The license shall be subject to the irrevocable, royalty- free right of the Government of the United States to practice and have practiced the invention on behalf of the United States and on behalf of any foreign government or international organization pursuant to any existing or future treaty or agreement with the United States.

(ii) The license shall be subject to any licenses in force at the time of the grant of the exclusive or partially exclusive license.

(iii) The license may grant the licensee the right to take any suitable and necessary actions to protect the licensed property, on behalf of the Federal Government.

(c) Federal agencies shall maintain a record of determinations to grant exclusive or partially exclusive licenses.

Sec. 404.8 Application for a license.

An application for a license should be addressed to the Federal agency having custody of the invention and shall normally include:

(a) Identification of the invention for which the license is desired including the patent application serial number or patent number, title, and date, if known;

(b) Identification of the type of license for which the application is submitted;

(c) Name and address of the person, company, or organization applying for the license and the citizenship or place of incorporation of the applicant;

(d) Name, address, and telephone number of the representative of the applicant to whom correspondence should be sent;

(e) Nature and type of applicant's business, identifying products or services which the applicant has successfully commercialized, and approximate number of applicant's employees;

(f) Source of information concerning the availability of a license on the invention;

(g) A statement indicating whether the applicant is a small business firm as defined in Sec.404.3(c)

(h) A detailed description of applicant's plan for development or marketing of the invention, or both, which should include:

(1) A statement of the time, nature and amount of anticipated investment of capital and other resources which applicant believes will be required to bring the invention to practical application;

(2) A statement as to applicant's capability and intention to fulfill the plan, including information regarding manufacturing, marketing, financial, and technical resources;

(3) A statement of the fields of use for which applicant intends to practice the invention; and

(4) A statement of the geographic areas in which applicant intends to manufacture any products embodying the invention and geographic areas where applicant intends to use or sell the invention, or both;

(i) Identification of licenses previously granted to applicant under federally owned inventions;

(j) A statement containing applicant's best knowledge of the extent to which the invention is being practiced by private industry or Government, or both, or is otherwise available commercially; and

mination to grant the license to applicant.

Sec. 404.9 Notice to Attorney General.

A copy of the notice provided for in Sec. 404.7(a)(1)(i) and (b)(1)(i) will be sent to the Attorney General.

Sec. 404.10 Modification and termination of licenses.

Before modifying or terminating a license, other than by mutual agreement, the Federal agency shall furnish the licensee and any sublicensee of record a written notice of intention to modify or terminate the license, and the licensee and any sublicensee shall be allowed 30 days after such notice to remedy any breach of the license or show cause why the license shall not be modified or terminated.

Sec. 404.11 Appeals.

In accordance with procedures prescribed by the Federal agency, the following parties may appeal to the agency head or designee any decision or determination concerning the grant, denial, interpretation, modification, or termination of a license:

(a) A person whose application for a license has been denied.

(b) A licensee whose license has been modified or terminated, in whole or in part; or

(c) A person who timely filed a written objection in response to the notice required by Sec. 404.7(a)(1)(i) or Sec. 404.7(b)(1)(i) and who can demonstrate to the satisfaction of the Federal agency that such person may be damaged by the agency action.

Sec. 404.12 Protection and administration of inventions.

A Federal agency may take any suitable and necessary steps to protect and administer rights to federally owner inventions, either directly or through contract.

Sec. 404.13 Transfer of custody.

A Federal agency having custody of a federally owned invention may transfer custody and administration, in whole or in part, to another Federal agency, of the right, title, or interest in such invention.

Sec. 404.14 Confidentiality of information.

Title 35, United States Code, section 209, provides that any plan submitted pursuant to Sec. 404.8 (h) and any report required by Sec. 404.5(b)(6) may be treated by the Federal agency as commercial and financial information obtained from a person and privileged and confidential and not subject to disclosure under section 552 of Title 5 of the United States Code.

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